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Patent Office
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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003903326 for a patent by AUSTRALIAN NATIVE MUSICAL INSTRUMENTS PTY LTD as filed on 27 June 2003.

WITNESS my hand this
Eighth day of July 2004

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Patents Act 1990

PROVISIONAL SPECIFICATION

Invention Title: **AMPLIFICATION OF ACOUSTIC GUITARS**

The invention is described in the following statement:

AMPLIFICATION OF ACOUSTIC GUITARS

FIELD OF THE INVENTION

The present invention relates generally to electronic amplification of acoustic instruments, and in particular to the amplification or recording of string instruments such as acoustic guitars. It should be understood however that the invention is not restricted to this example application and is intended for broader application and use.

BACKGROUND OF THE INVENTION

An acoustic guitar includes a body or resonant cavity having (i) a front panel, often referred to as the face or soundboard, (ii) a back panel and (iii) side walls extending between the soundboard and back panel. A neck, carrying a finger board, projects from the body and strings are stretched between a "nut" at the head end of the finger board and a "saddle" supported by a bridge attached to the soundboard of the instrument. The strings oscillate, when plucked or strummed, between the nut and the saddle.

In an acoustic guitar, these oscillations are transmitted mechanically as vibrations to the soundboard of the instrument, and hence to the resonant cavity, including the back panel and side walls. These vibrations are then transmitted to the surrounding air, predominately by the soundboard of the instrument but also by the back panel and side walls, and to some extent also by the stings directly.

The tonal qualities of an acoustic guitar are thus determined by a combination of all of these factors. Reproduction or amplification of an acoustic guitar therefore presents particular difficulties because of the complex interactions between these factors.

In the past, acoustic guitars have generally been recorded or amplified using piezoelectric sensors situated between the bridge and the saddle of the instrument, ie. immediately under the strings. Such systems will be referred to herein as "under saddle systems". The response achieved by under saddle systems is predominately the reproduction of vibrations of the strings according to how they are stretched between the nut and the saddle of the instrument, and of course the performance or playing of the instrument. The overall structure of the instrument effects the manner in which the strings vibrate and therefore the sound produced. Similar consideration thus apply to conventional "electrified" acoustic

guitars as apply to "electric" guitars, which may be solid and may not have a resonant cavity.

For an acoustic guitar, however, it is the soundboard or face of the instrument, the back and then the sides that are predominantly heard "acoustically", ie. without piezoelectric sensors or without power applied to them. These components of the resonant cavity vibrate in sympathy with the strings and, in turn, cause vibrations in the surrounding air. The sound or "character" of the instrument thus arises as a consequence of the construction of the instrument.

Since the piezoelectric sensors in under saddle systems are not in intimate contact with these other resonant components of the instrument, the vibrations of these other components are not reproduced to any significant extent.

Also, piezoelectric sensors that are commercially available, and used in most existing electronic amplification systems, are considered "metallic" in sound, are prone to "overload the top end", and are considered unrealistic in their sound reproduction, at least to some degree. Piezoelectric systems are thus not consistent with the "natural sound" (as heard acoustically), or at least the sound as recorded by means of a microphone placed in front of the instrument.

Inevitably, any comparisons of amplification systems are of a highly non-specific or of a subjective nature: different guitars, studios, equipment, players and so on being involved.

The sound actually heard during an acoustic guitar performance is also dependent on the environment in which the instrument is played as that environment has its own characteristic reverberation or reflections.

Whilst most musicians and recording engineers agree that systems using piezoelectric sensors (to produce the initial electrical output) deliver a palatable result, or an aesthetic result, it is a very different sound to that produced by the guitar when heard acoustically, or the sound recorded by a microphone placed in front of the instrument.

Using a microphone to amplify or record an acoustic guitar may produce a more realistic sound but this method of reproduction also has inherent limitations, particularly in a real performance space. Sources of sound other than the

intended source, being the guitar, are also detected by the microphone and amplified and/or recorded. This is clearly undesirable.

There have in the past been attempts to produce a more realistic amplified sound of an acoustic guitar by directly sensing vibrations in the soundboard or face of the instrument. However, such attempts have met with limited success because they have so far failed to produce a sound that is any more realistic than under saddle systems. The sound of these systems is different to that produced by under saddle systems but is no more convincing.

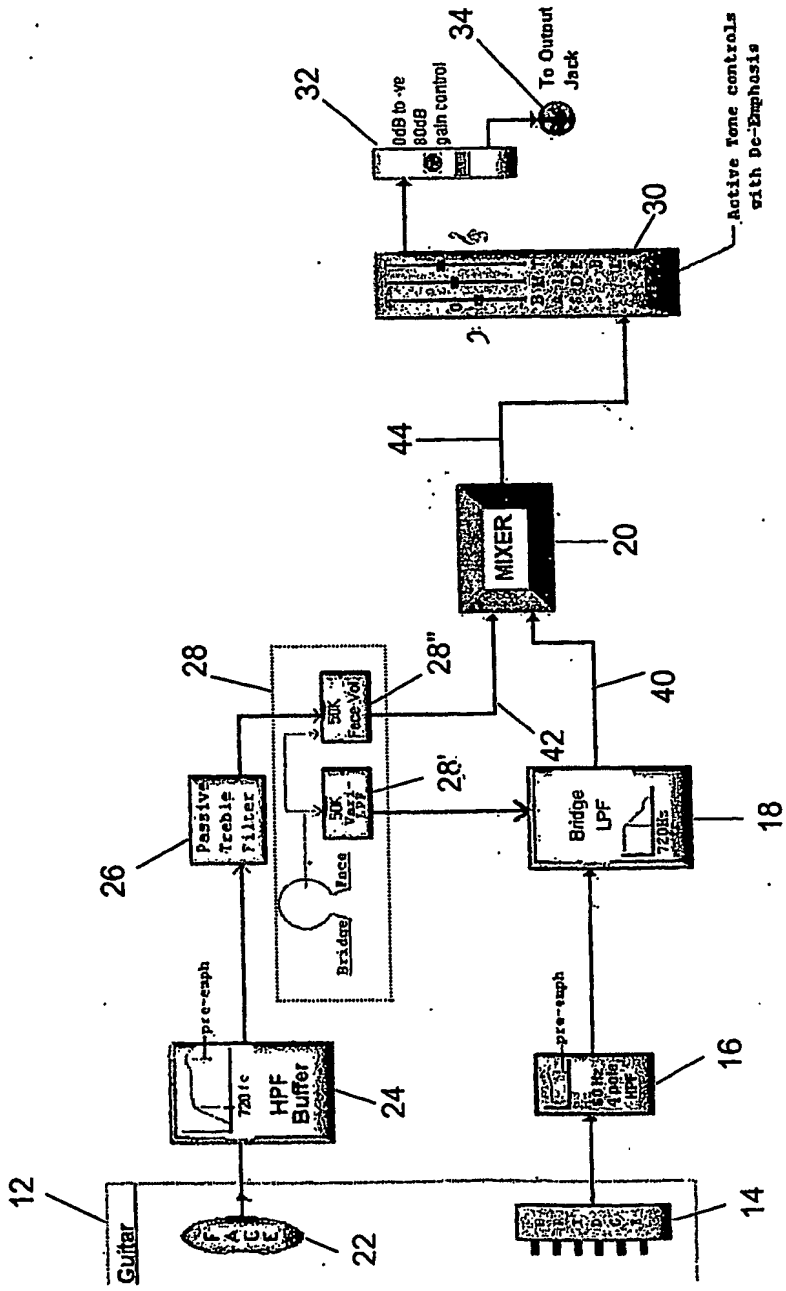
There therefore remains a need for a device or system which receives input signals directly from sensors placed in or on the instrument and uses these signals to produce a more realistic or natural sound than has presently been achieved.

Any discussion of documents, devices, acts or knowledge in this specification is included to explain the context of the invention. It should not be taken as an admission that any of the material formed part of the prior art base or the common general knowledge in the relevant art in Australia on or before the priority date of the claims herein.

SUMMARY OF THE INVENTION

The present inventor has found that lower frequencies of the audio spectrum, as heard by an observer within a performance space, are not well represented or reproduced by sensors attached to the soundboard of an instrument. The inventor believes this may be because the lower frequencies are generated over a large area of the instrument whilst soundboard sensors are necessarily in contact with only a limited area. On the other hand, the inventor has found that the lower frequencies are clear and well represented by under saddle sensors. This led to the proposition that a combination of sensors, each directed to a different range of frequencies, would more accurately represent the sound normally heard by a listener during an acoustic performance of an instrument such as a guitar.

The present invention thus resides in a recognition that it is possible to use a combination of sensors to detect different parts of the audio frequency spectrum from different parts of an instrument. In one embodiment, lower frequencies are



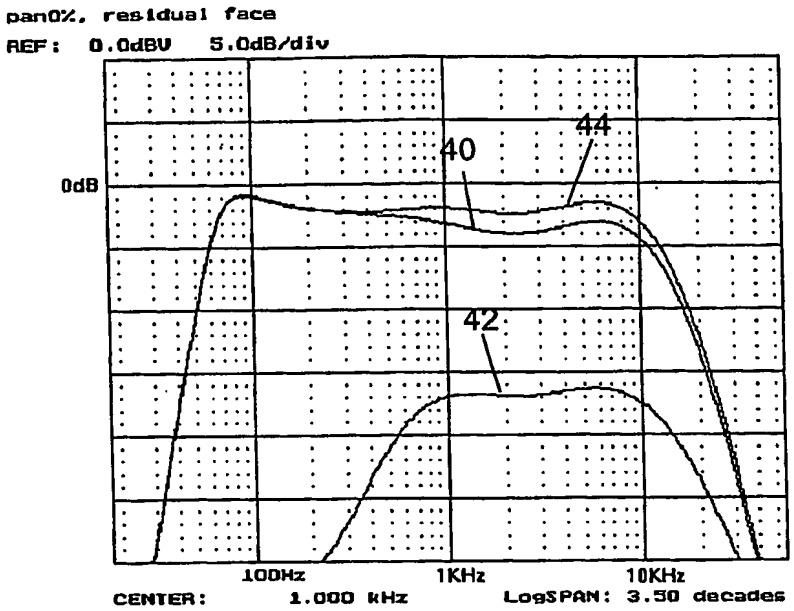


Figure 2A

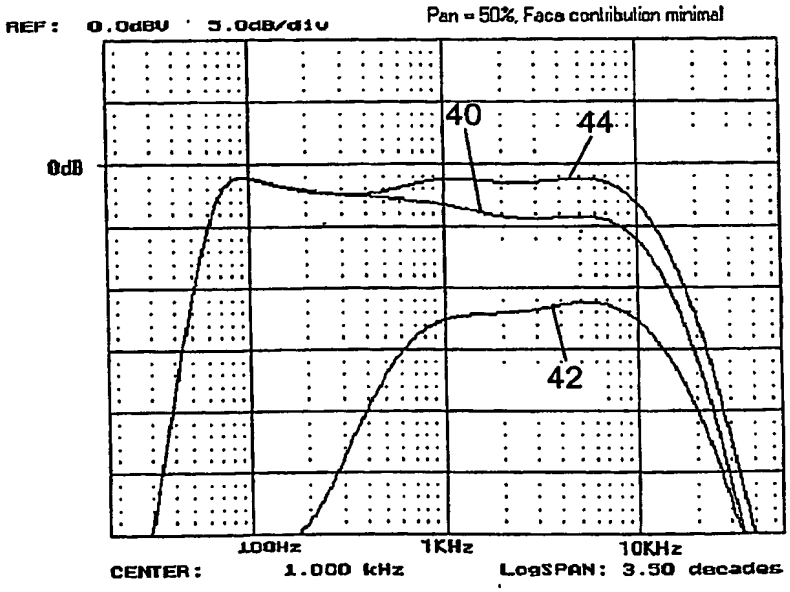


Figure 2B

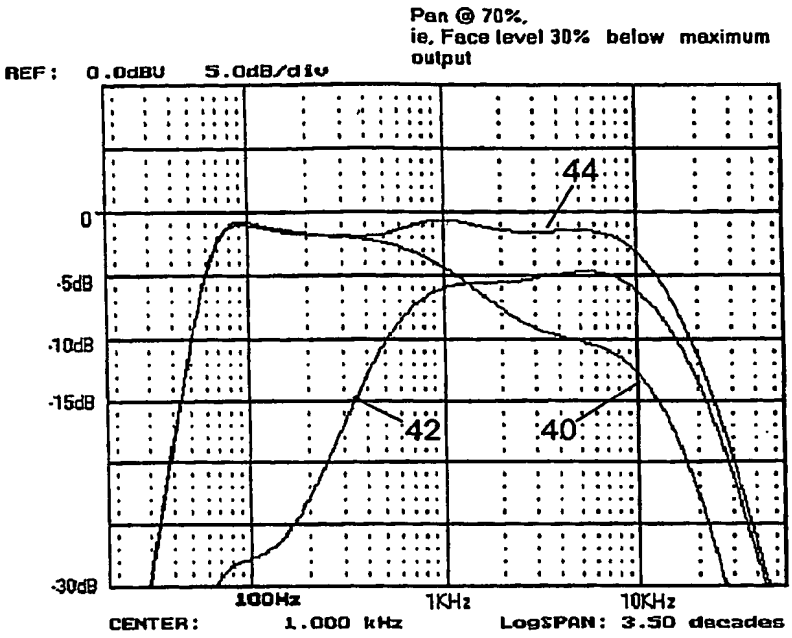


Figure 2C

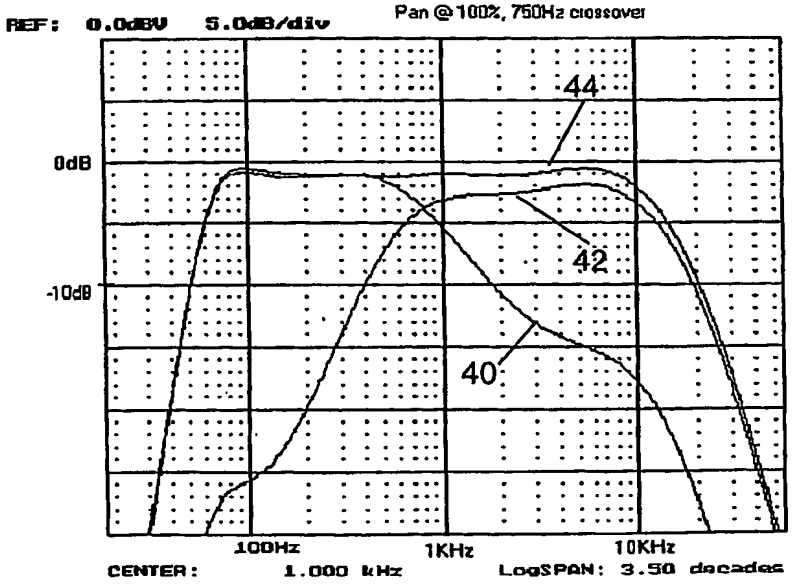


Figure 2D